The development in switchable FSS radome

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ABSTRACT

Index Terms:

BIOGRAPHY

Zhang Qiang graduated from East China Normal University in 1983 with bachelor degree, Nanjing Institute of Posts and Telecommunications (Now Nanjing University of Posts and Telecommunications) in 1985 with Master degree, Nanjing University of Posts and Telecommunications in 2005 with Ph.D. He has been with Nanjing Research Institute of Electronics Technology since March 1988 in the research field concentrating on the radome design and technology.

He has been chief engineer for many radome design of national key projects including the large air-borne radome and ultra-low side-lobe based radome.

He has proposed some new methods including wide-band & wide-angle FSS radome design technique、switchable FSS radome design technique and published quite a lot of papers including accurate and efficient method for analysis of scattering from dielectric shell, effects of Pittot tube on radome,fast calculation of ICR as well as ultra wide band radome analysis. He owned more than 10 China authorized invention patterns as first inventor. He has also been the adjunct professor of Nanjing University since 2010.

In January 2014 ,his book *Radome Theory and Design Methods* (in Chinese) was published by National Defence Industry Press and warmly welcomed by many readers, as well as high evaluation from many famous professors.

1 INTRODUCTION

2 Switchable Radome

3 New Switchable Radome

4 CONCLUSION

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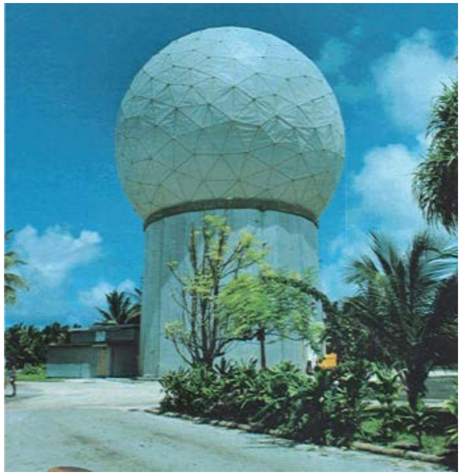
INTRODUCTION

1、INTRODUCTION



1、INTRODUCTION

RADOME

FSS RADOME

MUTIFUNCTION RADOME

Radome Theory and Design Methods

天线罩理论与设计方法

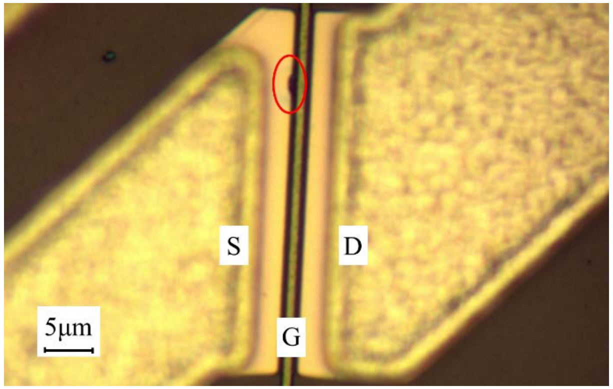
张强 著

国防工业出版社

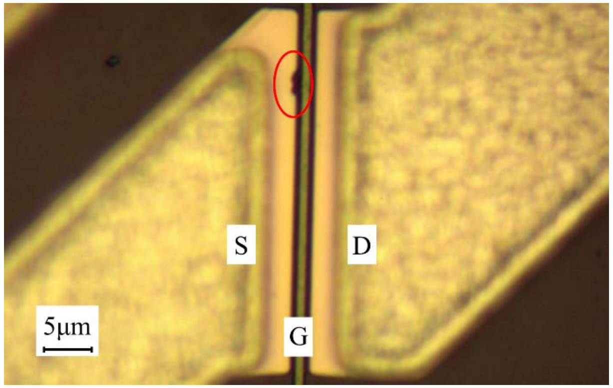
Zhang Qiang Radome Theory and Design Method [M]. National Defense Industry Press , 2014,1.

1、INTRODUCTION

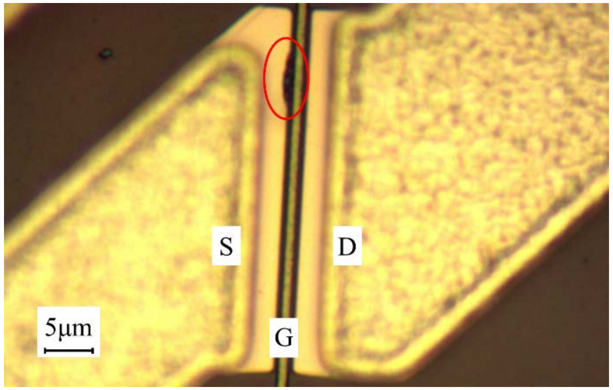
Prevent system from HPM damage



50~100个, 7.8dB



100~300个, 11dB



300~1000个, 16dB

The number of degraded increase as the power of incidental power

1、INTRODUCTION

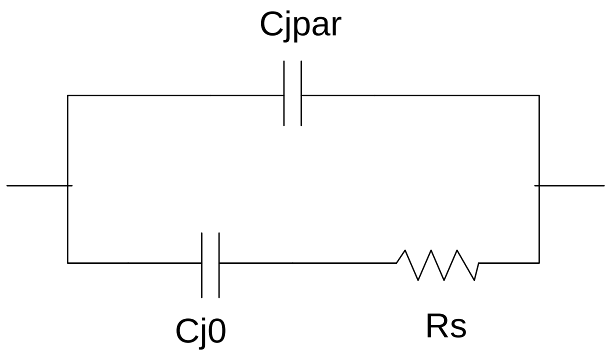


Figure 1. Equivalent circuit for switch when zero-bias voltage is applied

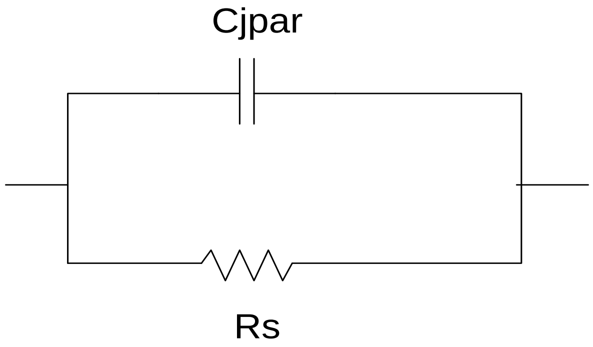
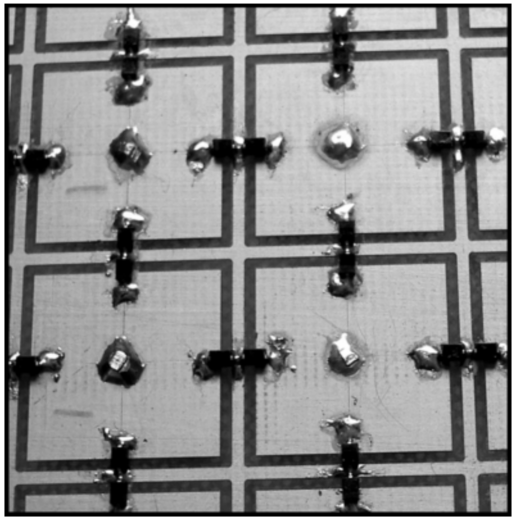


Figure 2. Equivalent circuit for switch when positive-bias voltage is applied

2

Switchable Radome

2、Switchable Radome



G.I. Kiani;K.L. Ford;L.G. Olsson;K.P. Esselle;C.J. Panagamuwa: Switchable Frequency Selective Surface for Reconfigurable Electromagnetic Architecture of Buildings. IEEE Transactions on Antennas and Propagation,vol58， No.2,Feb， 2010， pp81-584

2、Switchable Radome

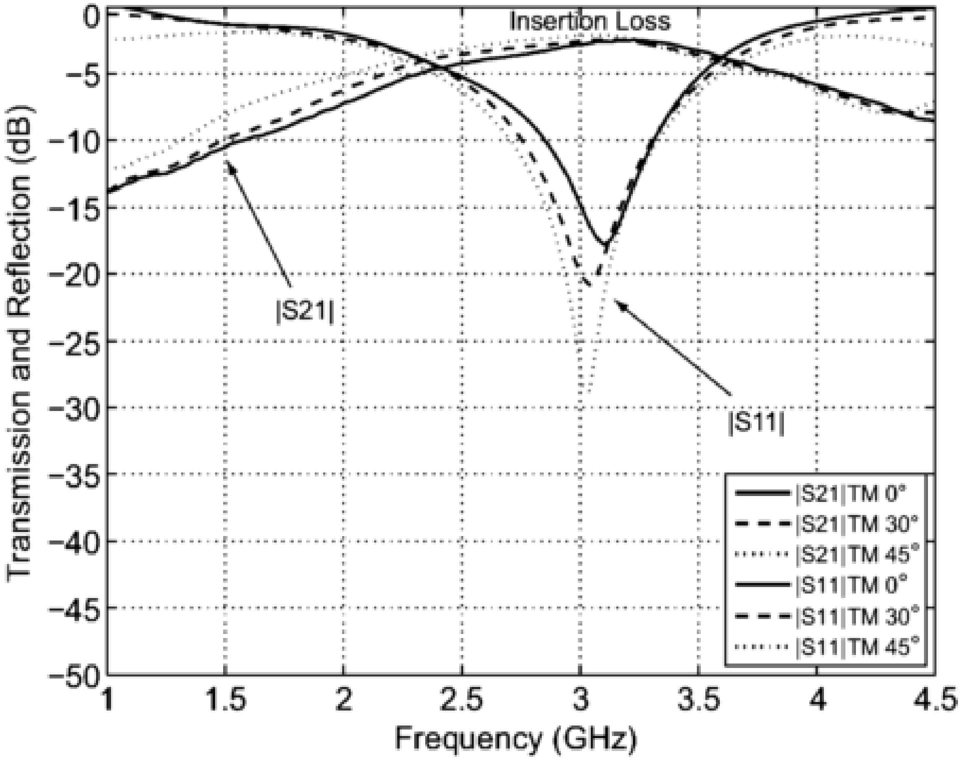


Figure 4 Measured results when diodes are in OFF status

2、Switchable Radome

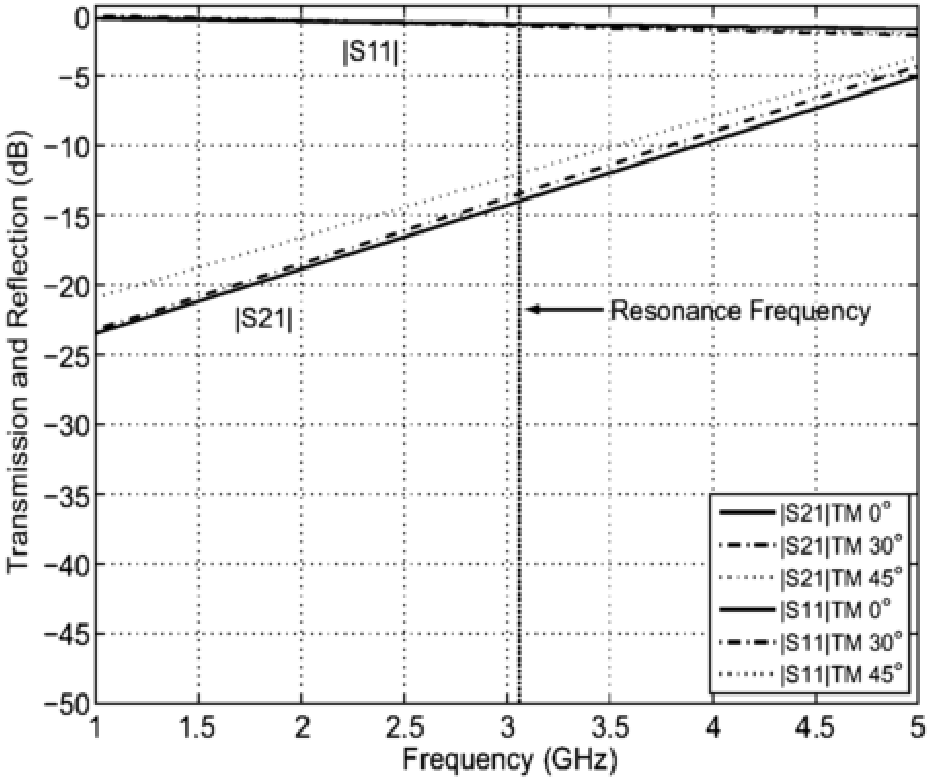
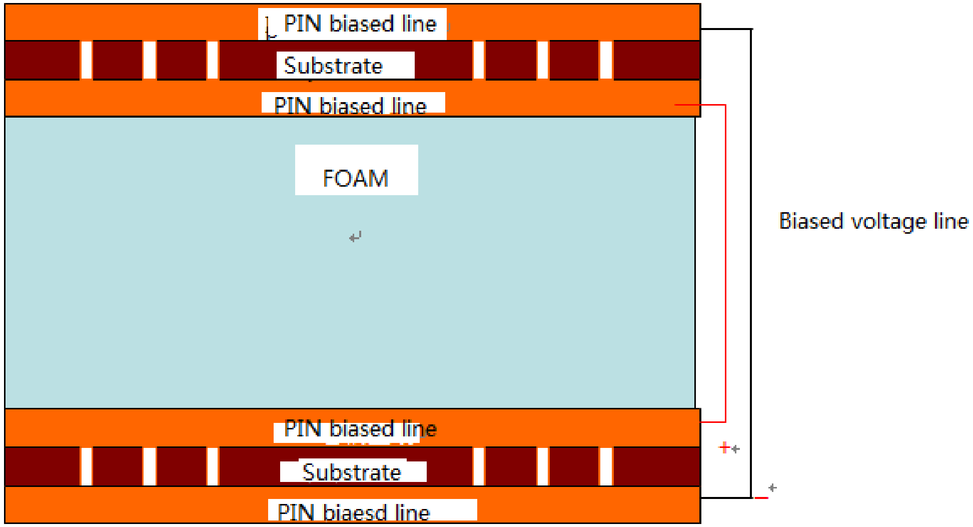


Figure 5 Measured results when diodes are in ON status

2、Switchable Radome

decrease the insertion loss, an improved design

2、Switchable Radome


PIN biased line
Substrate
PIN biased line
FOAM
PIN biased line
Substrate
PIN biaesd line
Biased voltage line
+
+

An improved design to decrease the insertion loss,

ZHANG Qiang， HU Mingchun， GAO Tie , ZHANG Cheng-gang,WANG Lichao A kind of active tunable FSS National defense Invention Patent : 201110014290.1，2012

2、Switchable Radome

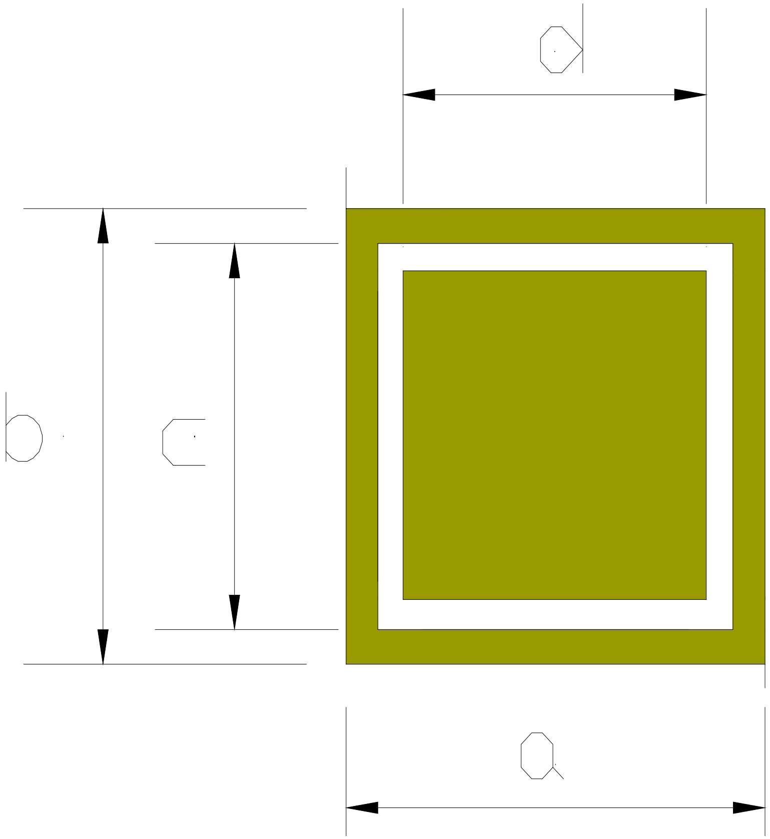


Figure 7 Pro-type FSS unit

2、Switchable Radome

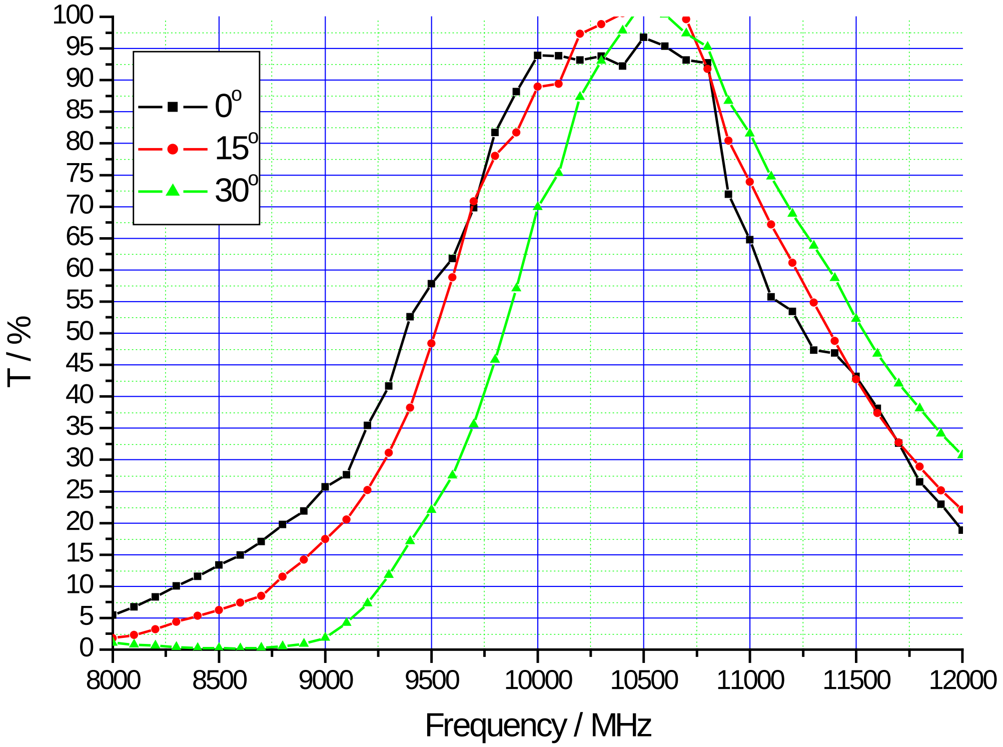


Figure 8 The measured power transmission when diodes is OFF status

2、Switchable Radome

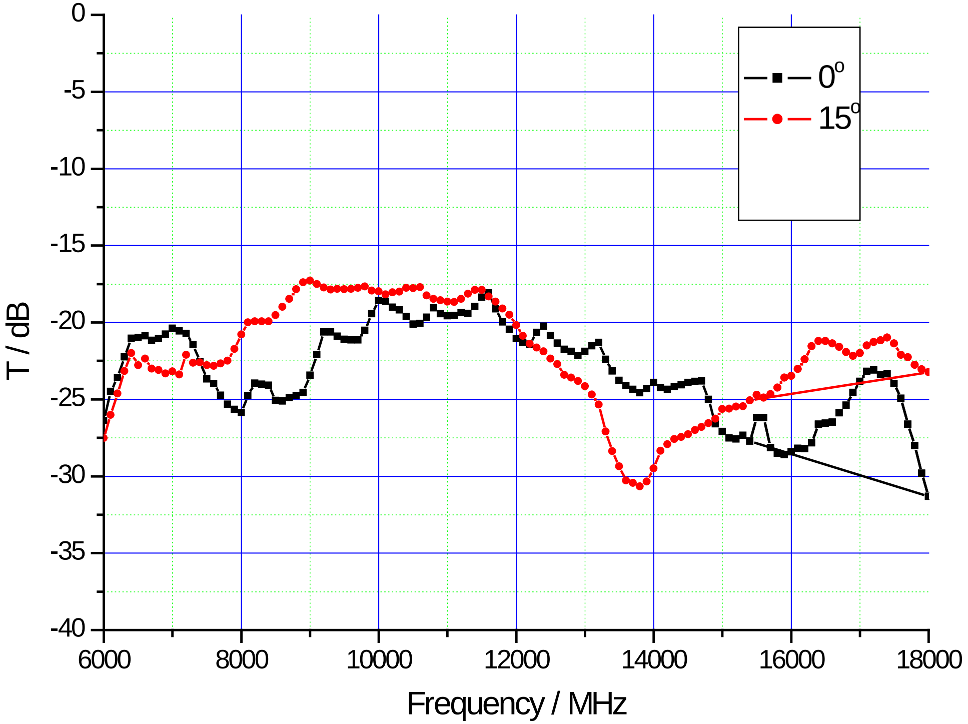
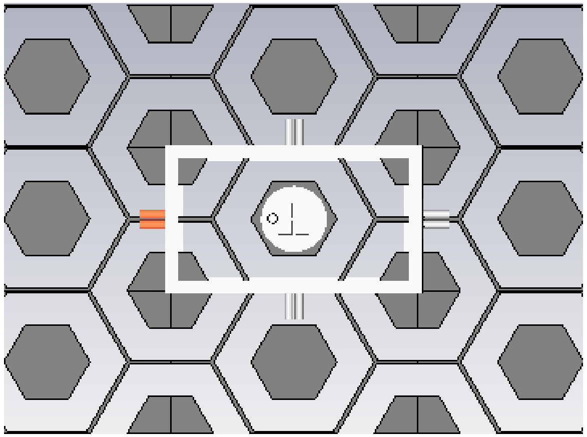


Figure 9 The measured power transmission when diodes is ON status

2、Switchable Radome



An improved design
to increase the bandwidth

ZHANG Qiang ,A kind of active FSS suitable for wide angle and wide band usage. National defense Invention Patent :ZL201218007765.X，2012

2、Switchable Radome

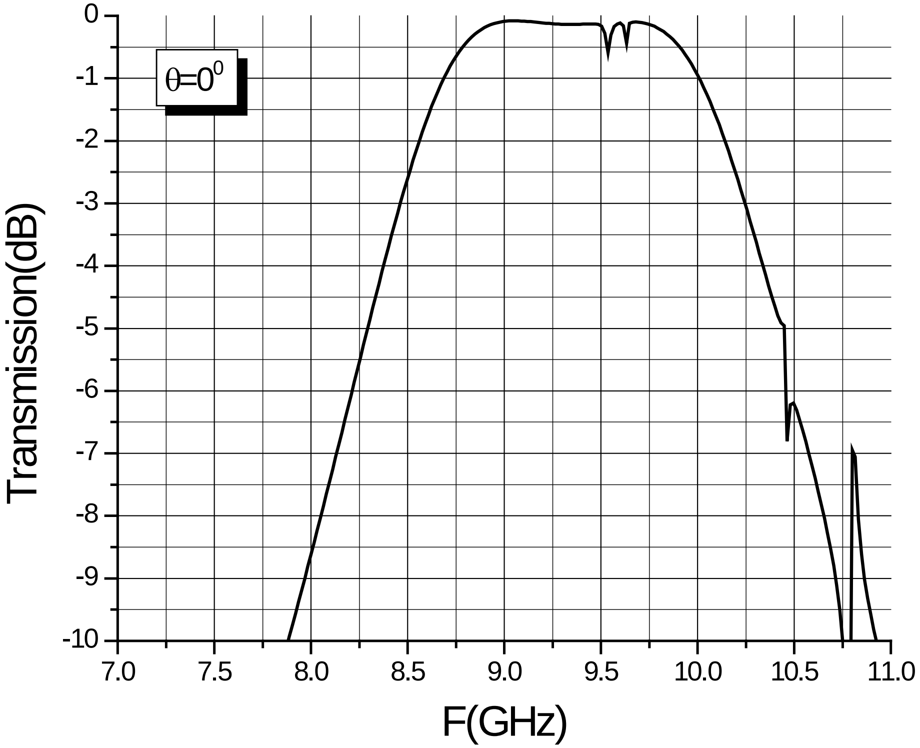


Figure 10 The simulated power transmission when diodes is OFF status，incidental angle=0°

2、Switchable Radome

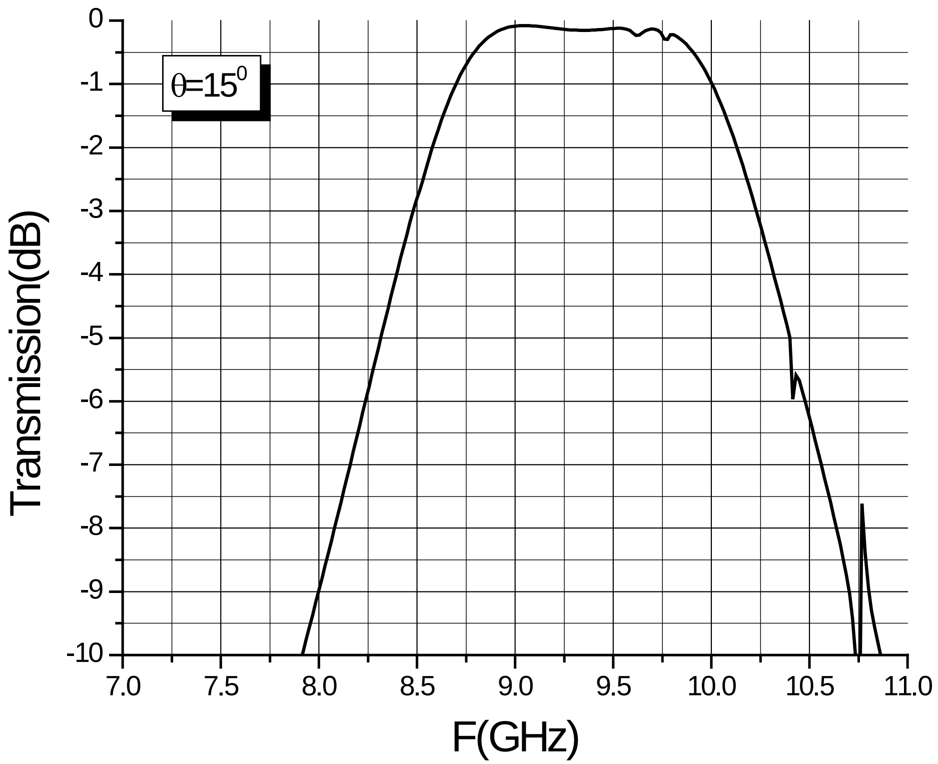


Figure 11 The simulated power transmission when diodes is OFF status， incidental angle=15°

2、Switchable Radome

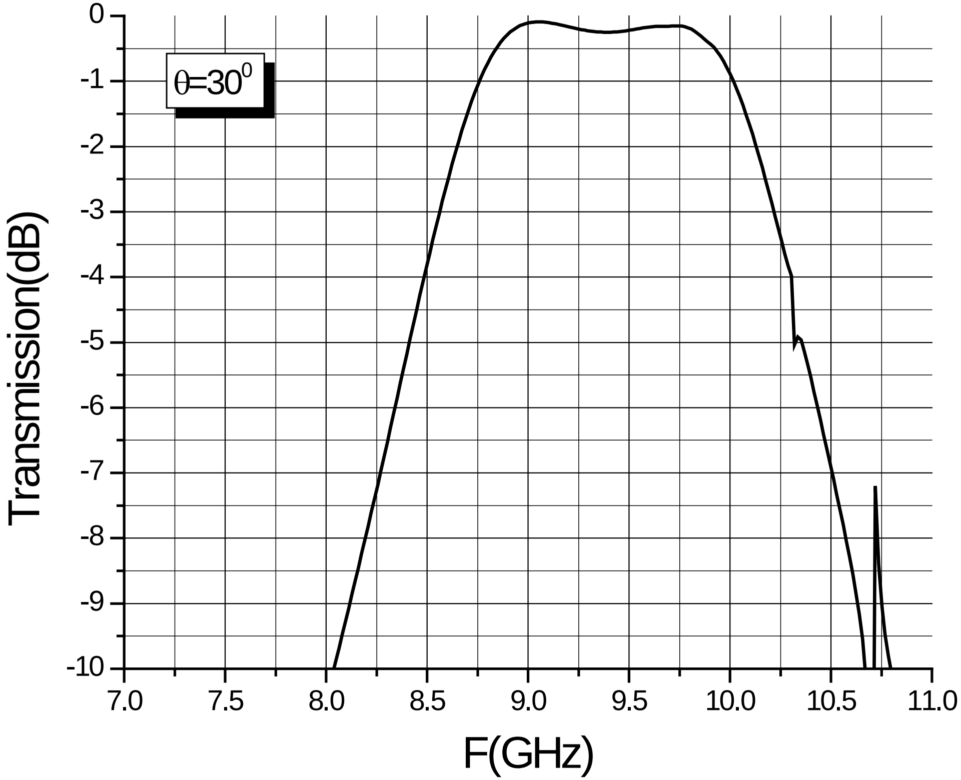


Figure 12 The simulated power transmission when diodes is OFF status， incidental angle=30°

2、Switchable Radome

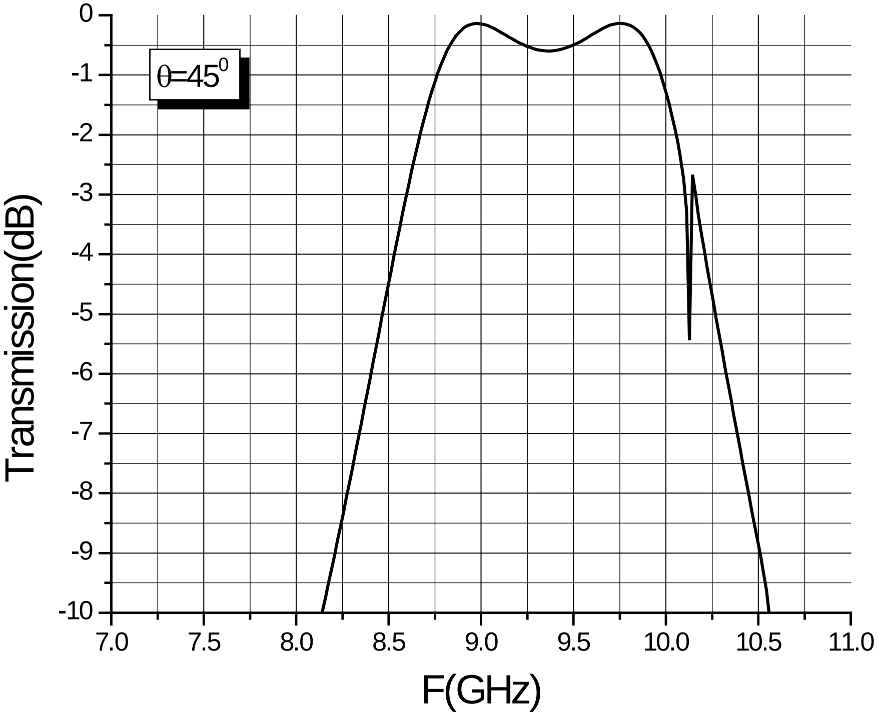
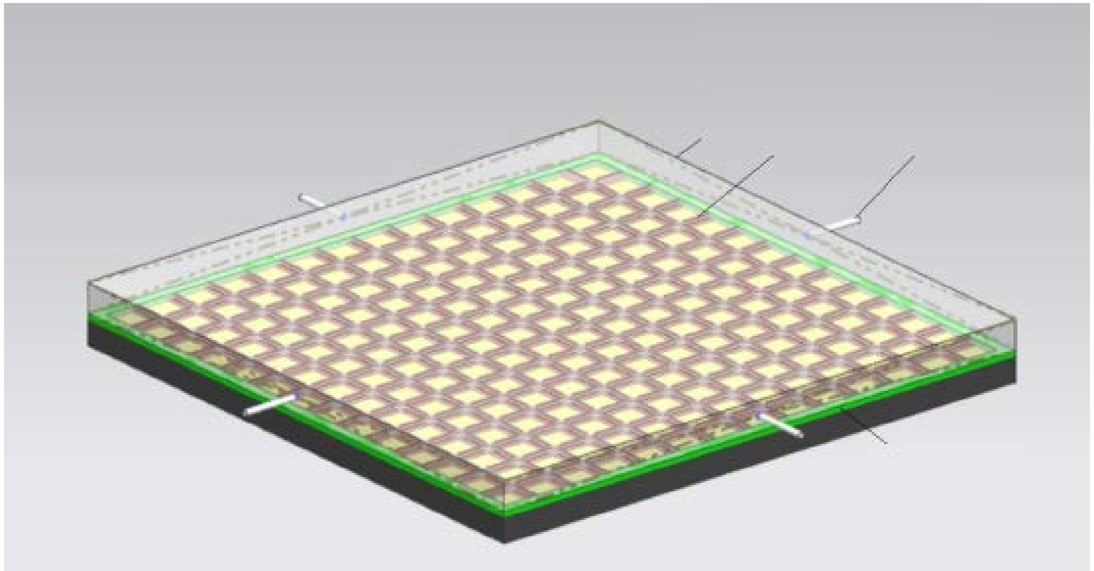


Figure 13 The simulated power transmission when diodes is OFF status，incidental angle=45°

3

New Switchable Radome

3、New Switchable Radome



An improved design significantly to increase the bandwidth

Figure 14 The switchable FSS based on PCCS

3、New Switchable Radome

Use PCSS to replace diode and control line

- Inference of biased line limited the bandwidth under 10% .
- We propose a new kind switchable radome controlled by laser.
- By using PCSS（photoconductive semiconductor switch） to replace the diode to eliminate the inference of biased line and decrease the parasitic capacitance
- The simulated results has shown that the bandwidth of switchable FSS radome can be increased up to 4 GHz at X band

3、New Switchable Radome

Use PCSS to replace diode and control line

- The sample test has shown that the ratio of light resistance to dark resistance is very satisfactory.
- By using PCSS, the bandwidth of PCSS-switch FSS radome can be widen much more than that of diode-switch FSS radome about 8 times or so. This design has been applied for invention pattern.

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CONCLUSION

4、CONCLUSION

- The switchable FSS radome opens a hopeful fields since the OFF status maintain the radar or communication system to works well while the ON status separate the system from outside for example, to protect system from being damaged by high power microwave weapon no matter from front-door or back-door ,or to filter un-necessary signals in time domain.

- It maybe changes the situation of interference and electronics-war.

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